US-PAT-NO: 5267956

DOCUMENT-IDENTIFIER: US 5267956 A

TITLE: Surgical cassette

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Detailed Description Text - DETX (3):
Coupling 506 may be any conventional type of coupling for making a fluid-tight junction between two fluid conduits. For example, coupling 506 may be a generally cylindrical fitting protruding from housing 502 and having a smooth or barbed exterior as preferred. Coupling 506 may be a tapered fitting such a male or female **luer** connector adapted to mate with a corresponding portion of the **luer** connector on housing 502. Coupling 506 may also be any conventional screw coupling, clamped coupling, quick-release hydraulic fitting or the like all of which are well-known. A preferred coupling 506 is a cylindrical or tapered friction fitting integrally molded in housing 502.

Detailed Description Text - DETX (8):
In a third embodiment of the present invention, illustrated schematically in FIG. 4, cassette 500 contains coupling 506, aspiration fluid inlet port 512, internal conduit 514, aspiration fluid flow control valve 526, aspiration fluid transfer conduit 528, integral waste receptacle 524, suction conduit 530 and pump 516. Pump 516 withdraws atmospheric air from waste container 524 through suction conduit 530, thereby reducing the pressure in waste container 524 and drawing aspiration fluid through aspiration line 508, inlet port 512, conduit

514, valve 526 and transfer conduit 528 and into waste container 514. In this embodiment, it is preferred that the aspirated fluid not reach pump 516 and **filter** 515, capable of permitting the passage of gas but excluding liquid, such as a hydrophobic or hydrophobic/hydrophilic **filter,** may be inserted in suction conduit 530. Pump 516 may be any type of vacuum pump capable of withdrawing air from waste container 524 and producing the reduced pressure needed for the operation of the aspiration function of surgical handpiece 10. For example, pump 516 may be a diaphragm pump or a venturi pump. Conduits 514, 528 and 530 are preferably integrally molded into housing 502. In particular, conduits 514, 528 and 530 may be molded as open channels in housing 502 and top gasket 136, as shown in FIG. 10, may be placed over the channels to form sealed conduits.

Detailed Description Text - DETX (17):

Bottom 143 of housing 502 contains pressure sensing chamber 164 and solid portion 133 having cassette retaining slot 134. Retaining slot 134 cooperates with a cassette retaining arm (not shown) on console 501 to retain cassette 500 within interface area 505. The control arm (not shown) is operated by control lever 112 on side 503 of console 501. As can be seen in FIGS. 10, 12 and 14, pressure sensing chamber 164 is generally round and consists of a thin-walled vertical cylinder 165 having a closed, slanted end 167 near top 145 and an open, generally T-shaped end 169 having a recess 173 of slightly larger **diameter** than cylinder 165 proximate to bottom 143. End 167 is slanted toward port 512 in chamber 164 so that air can escape chamber 164, making chamber 164 self-priming. Chamber 164 communicates with coupling 506 through horizontal

port 512 and communicates with conduit 514 through vertical port 156 that is integrally molded between conduit 514 and closed end 167 of chamber 164.

Detailed Description Text - DETX (19):

As can be seen in FIGS. 9, 11 and 26, front wall 140 contains waste container tab 602 having an eyelet 144 to which waste container 118 may be attached, couplings 506, 532 and 538 and pump tube notch 600 from which tube 518 exits housing 502. Coupling 506 is contained within recess 507 in housing 502 and communicates with chamber 164 through horizontal port 512. Coupling 532 is contained within recess 533 in housing 502 and communicates with horizontal conduit 544 through horizontal port 536 and vertical port 200 in conduit 544. Coupling 538 is contained within enlarged recess 539 in housing 502. Coupling 538 is larger in **diameter** than couplings 506 and 532 and has an internal bore 529 that accepts **filter** element 227. **Filter** element 227 is retained within bore 539 by **filter** retainer 226 having coupling 229. **Filter** retainer 226 may be retained on coupling 538 by any suitable means, such as friction or suitable adhesive, and is of similar construction as housing 502. Coupling 538 communicates with horizontal conduit 548 through horizontal port 542 and vertical port 220 in conduit 548 and communicates with port 231 in coupling 229 on **filter** retainer 226 through **filter** element 227.

Detailed Description Text - DETX (20):

As can be seen in FIGS. 10, 11, 23, 24 and 25, elastic molding 262 is generally dumbbell-shaped and consists of a hollow pressure sensing port nipple 192 having a bore 195 and a sealing ring 193 equally spaced between two

identical circular valve diaphragms 234 and 258 each having a sealing rim 236
and 260, respectively. Valve diaphragms 234 and 258 each have a recessed
sealing face, 235 and 259, respectively, and valve actuation surface 261 and
237 opposite valve faces 235 and 259, respectively, that contain control
dimples 655. Sealing faces 235 and 259 may be any suitable **diameter** but a
diameter of approximately one-quarter inch (1/4") is preferred. Molding 262
can be made of any suitably resilient material such as silicon rubber,
sanoprene or J-Von.

Detailed Description Text - DETX (21):

The pressure level within conduit 514 is monitored by a pressure sensor (not
shown) within console 501. To prevent contaminated fluid from entering the
pressure sensor (not shown), pressure sensing chamber 164 having cylinder 165,
diaphragm 166, diaphragm cover 170 and bottom gasket 184 is used as shown in
FIGS. 12, 19, 20, 21 and 22. Diaphragm 166 is slightly larger in **diameter** than
chamber 164 and is made of an elastic material such as silicone rubber. As can
be seen in FIGS. 19 and 20, diaphragm cover 170 is generally circular, has a
rounded interior surface 181 having a protruding rim 171 and a coupling 180
having a port 178, an exterior surface 179 having support ribs 670 and radial
channel 176, a central port 174 in fluid communication with interior surface
181 and exterior surface 179. Port 178 and port 174 communicate with each
other through radial channel 176.

Detailed Description Text - DETX (22):

As can be seen in FIGS. 12 and 20, diaphragm 166 is placed on front surface
181 of diaphragm cover 170 so that hole 168 in diaphragm 166 fits over coupling

180 on cover 170. Diaphragm cover 170 containing diaphragm 168 is placed in
open end 169 of chamber 164 so that rim 171 contacts recess 173 and coupling
180 journals into bore 182, which is in communication with pressure sensing
port 186. Bottom gasket 184, which is round and generally the same **diameter** as
diaphragm cover 170, is placed on exterior surface 179 of diaphragm cover 170,
thereby sealing ports 174 and 178 and channel 176 into a fluid-tight conduit.
Gasket 184 is similar to gasket 136, may be made of any suitable material and
may be attached to diaphragm cover 170 by any suitable means. However, a clear
polyester film such as that sold under the trademark MYLAR.RTM. and a pressure
sensitive adhesive such as heat activated polyurethene are preferred.

Detailed Description Text - DETX (26):

Aspiration line 508, which is connected on one end to surgical handpiece 10,
is connected at the other end to coupling 506. Irrigation fluid supply line
534 is connected on one end to a supply of pressurized irrigation fluid (not
shown) and on the other end to coupling 532. Irrigation fluid outlet line 540
is connected on one end to surgical handpiece 10 and on the other end to
coupling 229 on **filter** retainer 226.

Detailed Description Text - DETX (28):

Irrigation fluid is supplied to cassette 500 from a pressurized source (not
shown) through irrigation supply line 534 and enters cassette 500 through
irrigation fluid inlet port 536 where it is conducted to valve 546 through
conduit 544. Conduit 560 branches off from conduit 544 and conducts a portion
of the irrigation fluid to valve 558. In its relaxed position, sealing face
235 on diaphragm 234 seals tightly against fact 208 on

valve 546 to prevent the
flow of irrigation fluid through vertical port 204 and out horizontal port 210.
When irrigation fluid is needed, the valve actuator (not shown) in interface
slot 505 of console 501 retracts so that the fluid pressure within the system
pushes diaphragm 234 away from valve face 208 a small amount (on the order of
0.020 inches), allowing irrigation fluid to flow up vertical port 204, out
horizontal port 210 and across valve face 208 where it enters horizontal port
212, flows up vertical port 216, along horizontal conduit 548, down vertical
port 220, through horizontal port 542 and **filter** element 227, out port 231 in
coupling 229 and into handpiece supply line 540.

Detailed Description Text - DETX (30):
In an eighth embodiment of the present invention, illustrated in FIGS.
28-32, cassette 700 contains external peristaltic pump tube 702, housing 704,
molding 706, front gasket 708, rear gasket 710, collection container 712 and
hydrophobic **filter** 714 that prevents liquid from entering vent 754 or air vent
line 744. Housing 704 contains aspiration fluid inlet coupling 746, irrigation
fluid inlet coupling 748, irrigation fluid outlet coupling 750 and peristaltic
pump tube inlet 716 and peristaltic pump tube outlet 718 that are offset from
each other relative to front 720 and rear 722 of cassette 700. As can best be
seen in FIG. 30, this offset or diagonal orientation of pump tube 702 forces
pump tube 702 into winding slot 726 in roller head 724 when cassette 700 is
placed within interface slot 728 in the console (not shown). When roller head
is initially rotated, winding slot 726 winds or stretches pump tube 702 over
roller head 724, eliminating the need for pump tube 702 to be manually wound
over roller head 724. As roller head 724 completes one

full revolution, pump
tube 702 slides out of winding slot 726 and becomes fully stretched over and
frictionally engaged with roller head 724.

Detailed Description Text - DETX (31):
Housing 704 may also contain capacitance chamber 730 that is closed to front
720 of cassette 700 and open to rear 722 of cassette 700 and a plurality of
irrigation and aspiration fluid flow passage forming channels 732 that are open
to rear 722 of cassette 700. Chamber 730 and channels 732 are sealed fluid
tight by rear gasket 710. As discussed above, channels 732 are arranged so
that irrigation fluid entering cassette 700 through irrigation fluid inlet
coupling 748 can be directed into pump tube 702 to quickly increase the
pressure within pump tube 702 if required by the surgeon. However, the
pressure within pump tube 702 can be much lower than the pressure within
irrigation line 734, and when irrigation valve 752 is opened to allow
irrigation fluid to enter pump tube 702, the reduced pressure within pump tube
702 can cause irrigation line 734 to act as a suction line and draw fluid from
the eye. To help prevent such an occurrence, chamber 730 acts as a pressure
capacitor to smooth out pressure fluctuations within irrigation line 734. As
can be seen in FIG. 32, when irrigation line 734 is pressurized with irrigation
fluid, gasket 710 expands slightly to increase the volume of irrigation fluid
in chamber 730. If the pressure level within irrigation line 734 drops
suddenly, the elastic nature of rear gasket 710 causes it to contract, thereby
helping to maintain a positive pressure within chamber 730 and smooth out any
pressure fluctuations. In addition, as illustrated in FIG. 32, chamber inlet
738 and chamber outlet 733 may contain barbs 742 that

permit irrigation fluid
flow through inlet 738 into chamber 730 and out of chamber 730 through outlet
733 but **restrict** irrigation fluid **flow** backwards through outlet 733 into
chamber 730 and out of chamber 730 through outlet 740, thereby helping to
prevent irrigation fluid from leaving the **eye**.